

ITN Energy Systems, Inc., Littleton, CO

2.5kW/10kWh Redox Flow Battery (RFB) with Low-cost Electrolyte and Membrane Technologies

\$2.1 M, 33-month program awarded by ARPA-E Sept 7, 2012

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- Innovative, high energy density Mn-V based RFB electrolytes as a low-cost alternate to all-Vanadium systems
- Low-cost membrane technology, based on renewable biopolymer Chitosan with improved proton conduction & chemical stability, adaptable to Mn-V system
- Scale-up of electrolyte and membrane technologies in pursuit of ARPA-E's goal for a 2.5kW/10kWh RFB stack with integrated BoS at a total cost of ~\$1000/unit and ~1.2 m³ footprint

Technology Impact

Cost-effective & reliable Mn-V RFB technology as a direct response to multiple end user demands for grid-connected energy storage and deployment, for which the international market is expected grow to ~\$11 B by 2016

Program Targets

Phase I (9 months): Demonstrate a ~150 cm² active area flow cell with OCV > 1.7V; discharge voltage >1.5V; efficiency > 80%; and peak power density >500mW/cm²

Phase II (24 months): Demonstrate RFB system with OCV > 1.7V; discharge voltage >1.5V; efficiency > 80%; and peak power density >750mW/cm²; capacity of 10kWh; cycle life >30 cycles

Metrics	State of the Art (VRFB)	ITN/UKy's Mn-V RFB
Power Density (mW/cm²)	300	750
System Cost (2.5kW/10kWh)	\$2,200	\$1,100
Round Trip Efficiency	80%	>80%
Stack Materials	\$890*	\$210
Electrolyte Cost	\$780*	\$456

^{*}Data based on publicly available sources

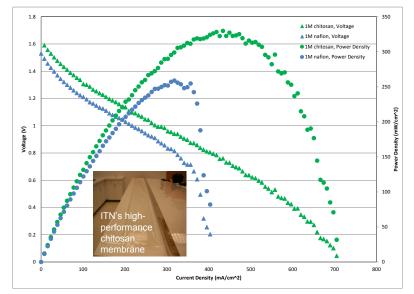


ITN program's 2.5kW/ 10kWhr RFB device



KENTUCKY

volumetric energy density over all-Vanadium RFB



Superior performance of ITN's Chitosan over Nafion® membranes in VRFB

